

Remarks

Claims 1-15, 18 and 28-36 are cancelled. Claims 16 and 20-24 are amended. The Applicants respectfully request entry of the amendments which are believed to place the application in better condition for allowance or, alternatively, appeal. Support for the amendments to Claim 16 can be found in now cancelled Claim 18 and in the Applicants' Specification on page 38, line 15 and Example 1. Other amendments to the claims are merely made for the sake of clarity.

At the outset, the Applicants wish to thank the Examiner for the helpful interview of May 6, 2009 in which the rejections were discussed. The Applicants discussed potential amendments to Claim 16 during the interview. Some of those changes have been made as discussed. However, the Applicants note that Claim 16 has now been amended to include the subject matter of Claim 18. This distinguishes over the prior art.

The interview also involved a discussion of the point of continuing the resin evacuation until reaching the target fiber volume content. The Examiner asserted that continuing the evacuation until reaching the target fiber volume content is disclosed in US '537. However, the Applicants' Example 8 shows an amount of resin much greater than the volume reduction rate (about 1.2%) due to curing by heating is evacuated. In Example 8, a high fiber volume content is achieved by reducing the resin impregnated into the laminate by 15% or more in thickness from 28.1 mm down to 23.8 mm. Thus, the Applicants respectfully submit that positively continuing evacuation of resin **FROM INSIDE OF THE LAMINATE** is neither disclosed nor suggested in US' 537.

Claims 16, 18 and 22-24 are rejected as anticipated under 35 USC §102(b) by US '537.

The rejection is now moot with respect to cancelled Claim 18.

Claim 16 recites that, after the resin injection is stopped, at least one line of the resin injection lines is changed to an evacuation line and the resin evacuation is continued, and after the resin evacuation is stopped at the time reaching the target fiber volume content (or, at the time reaching a plate thickness corresponding to the target fiber volume content or at the stage reaching a target evacuation amount), temperature elevation is carried out by heating to cure the resin. One such embodiment, wherein evacuation is stopped at the stage reaching a target evacuation amount, is described in the Applicants' Example 7, and another embodiment, wherein evacuation is stopped at the time reaching a plate thickness corresponding to the target fiber volume content, is described in

Example 8, respectively.

US '537 discloses that the resin content is managed by manipulating valves until the resin cures (column 6, lines 40-48). However, it is not disclosed that the resin is evacuated from at least one injection port and the evacuation port, and after stopping the resin evacuation, the resin is cured by heating.

Further, in Examples 7 and 8, by the molding method according to Claim 16, "As the result of determination of the fiber volume content of the CFRP molded material at positions of the resin injection side, the evacuation side and an intermediate point therebetween, they were in a range of 57.2 % to 58.2 %." (paragraph [0169] of US 2006/0125155A1), and "a CFRP molded material having a fiber volume content of 57.1 to 59.3 % within a range of the above-described target fiber volume content could be obtained." (paragraph [0172]). Thus, a remarkable advantage can be obtained wherein a stable molded material with little dispersion of fiber volume content over the entirety of the molded material can be obtained.

This important point is explained below. Immediately after resin injection is stopped, an excessive amount of resin is stored at the side of the resin injection port, the pressure is high. On the other hand, the amount of resin at the side of evacuation port is small, and in a low-pressure condition. In the Applicants' methods, by positively evacuating the resin from the resin injection port side, because the excessive resin at the injection port side can be positively discharged, the distributions of the amount of resin and pressure in the cavity can be stabilized over the entirety of the molded material.

Further, in a case where resin is cured while the resin evacuation is continued, because the resin cures at a condition where the resin amount at the evacuation port side is locally small, there is a problem that the dispersion of fiber volume content in the molded material becomes great. As in the Applicants' methods, by stopping the resin evacuation at the time of reaching the target fiber volume content, the resin amount and pressure in the cavity can be stabilized over the entirety of the molded material and, thereafter, by heating and curing the resin, the fiber volume content over the entirety of the molded material can be stabilized.

US '537 does not disclose, teach or suggest this concept of positively injecting the resin, controlling the evacuation line and stopping evacuation before curing of the resin to stabilize the fiber volume content, much less a solution or means to do so.

The rejection states that in US '537 "the preform is compacted to a lower volume after being placed in the mold[.]" This is different than the claimed methods which recite a step of "reducing pressure in said mold by evacuation [(emphasis added).]" This means, in the claimed methods, the preform is reduced in pressure and is not compacted by applying external pressure as in US '537. Further, in the claimed methods, the preform is prepared in advance to have a fiber volume content lower than the target fiber volume content of the FRP (fiber reinforced plastic) molded material. Thus, the target fiber volume content is achieved in the claimed methods by reducing the pressure in the interior of the mold by evacuation, regardless of whether compaction is performed or not. This apparent difference from US '537 is significant because the claimed methods permit the porosity to remain high and provides the remarkable advantage that "the resin can be impregnated sufficiently over the entire area of the reinforcing fiber substrate and, at that time, generation of resin non-impregnated portions can be prevented" even when the resin is impregnated. See the paragraph spanning pages 16 and 17 of the originally filed application. This means that US '537 does not appear to teach the fiber volume content of the preform is reduced and, therefore, that the technical concept of the claimed methods is different from the technical concept of US '537 in which the apparent fiber volume content may be changed by the operation of compaction.

Furthermore, the above interpretation of the disclosure in US '537 is also consistent with the technical "common sense" of a person of ordinary skill in the art working in the vacuum RTM field at the time this application was filed. The Applicants respectfully submit that such a person of ordinary skill in the art would understand that in US '537 impregnation is completed when the resin impregnated into the reinforcing fiber substrate reaches the evacuation line and that, at this point, the curing process is promptly initiated. This means one of ordinary skill in the art would not conclude from US '537 that the resin impregnated into the reinforcing fiber substrate is subjected to a further evacuation step "until reaching...[a] target fiber volume content" as in the claimed methods.

Additionally, the forcible evacuation of the resin from the inside of the reinforcing fiber substrate already impregnated with resin in the claimed methods is clearly described in the paragraph spanning pages 14-15 of the originally filed application. This means the claimed methods are distinct from the condition where the fiber volume content after curing increases as compared with the fiber volume content after impregnation as shown in the above-mentioned Examples 7 and 8, in

which an increase in fiber volume content, more than a change in volume accompanying with curing of resin, is clearly shown.

The Applicants also note that US '537 appears to measure and define fiber volume differently than Claims 16 and 22-24. As discussed during the interview, one way in which the “fiber volume content” may be defined and measured is as the volume of fiber in a molded item relative to the total volume of a molded item. This appears to be how the “percent fiber volume” in US '537 is defined when it states at column 3, line 53 that the “percent fiber volume of a given [molded] part is limited by the thickness of preform [(emphasis added)].”

However, “fiber volume content” may also be differently defined and measured as the volume of fiber within a boundary defining the total volume of fiber material (e.g., if a steel wool sheet were compressed the fiber volume content would represent the volume of steel wool fiber within a boundary defining the total volume of the steel wool sheet). This is how fiber volume content is defined and measured in the context of the claimed methods and is different than in US '537.

This is also apparent from the recitations in amended Claim 16 that the “fiber volume content,...is a volume of reinforcing fibers in the bulk volume of the reinforcing fiber substrate[.]” The recitation in amended Claim 22 that “reaching said target fiber volume content is determined by measurement of a thickness of said reinforcing fiber substrate” similarly makes this apparent. Additionally, this is consistent with the first full paragraph on page 24 of the originally filed application which states “the fiber volume content of reinforcing fibers can be increased [(emphasis added)]” and the V_f estimation equation spanning pages 37 and 38, as well as the first full paragraph on page 16 and through to the top of page 17. All of these provide support for measuring the fiber volume content as the volume of fiber within a boundary defining the total volume of fiber material (i.e., the bulk volume of the reinforcing fiber substrate). Thus, the “percent fiber volume” referred to in US '537 is different than the recited “fiber volume content” of amended Claims 16, 18 and 22-24. This means that US '537 also fails, on this basis, to teach all the elements of amended Claims 16, 18 and 22-24.

Altogether, the above makes it clear that US '537 fails to teach all the elements of Claims 16 and 22-24 and, thus, cannot anticipate Claims 16 and 22-24.

The Applicants respectfully request the withdrawal of the rejections of amended Claims 16 and 22-24 under 35 USC §102(b).

Claim 19 is rejected as obvious under 35 USC §103(a) over the combination of US '537 and WO '392.

Claim 19 is not obvious under 35 USC §103(a) over the combination of US '537 and WO '392. This is because the citation of WO '392 does nothing to cure the deficiencies of US '537 discussed above. Furthermore, in WO '392 it appears the fibers are impregnated with thermoplastic resin beforehand and are laminated, these thermoplastic laminates are scattered or cut to create plastic chunks, and this scattered resin material is then heated and pressure melted to form a molded material. Thus, the methods of WO '392 are different from the claimed methods with regard to both the molding method and the applied resin. In fact, if the methods of WO '392 and US '537 were combined, the result would be a method in which a pile of scattered chunks of resin impregnated fiber material is impregnated with resin to produce a resin material containing an aggregate of embedded chunks of resin impregnated fiber which would then be melted and formed, by press molding as taught in WO '392, into a molded resin material containing an aggregate. This means the combination of US '537 and WO '392 would lead to a different method than those claimed and that one of ordinary skill in the art would not be motivated to combine the teachings of US '537 and WO '392 or have a reasonable expectation of success on so doing. Stated differently, the rejection fails to establish *prima facie* obviousness because the combination of US '537 and WO '392 fails to teach all the elements of amended Claim 19.

The Applicants respectfully request withdrawal of the rejection of amended Claim 19 under 35 USC §103(a) over the combination of US '537 and WO '392.

Claims 20 and 21 are rejected as obvious under 35 USC §103(a) over US '537.

Amended Claims 20 and 21 are not obvious under 35 USC §103(a) over US '537. This is because, as discussed above, US '537 fails to teach all the elements of the amended claims. Stated differently, the rejection fails to establish *prima facie* obviousness because US '537 fails to teach all the elements of amended Claims 20 and 21.

The Applicants respectfully request withdrawal of the rejection of amended Claims 20 and 21 under 35 USC §103(a) over US '537.

Claims 25, 26 and 27 are rejected as obvious under 35 USC §103(a) over the combination of US '537 and JP '426.

Amended Claims 25, 26 and 27 are not obvious under 35 USC §103(a) over the combination of US '537 and JP '426. This is because, as discussed above, US '537 fails to teach all the elements of the amended claims and the citation of JP '426 does nothing to cure these deficiencies of US '537. Stated differently, the rejection fails to establish *prima facie* obviousness because the combination of US '537 and JP '426 fails to teach all the elements of amended Claims 25, 26 and 27.

The Applicants respectfully request withdrawal of the rejection of amended Claims 25, 26 and 27 under 35 USC §103(a) over the combination of US '537 and JP '426.

In light of the foregoing, the Applicants respectfully submit that the entire application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,



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